# Thermodynamic Irreversibility of the Flow and Transfer Phenomena Within Streamlined Structures of the Catalytic Reactors


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An analysis is presented of the irreversibility of flow and thermal phenomena in innovative streamlined structured packing of catalytic chemical reactors. The fundamental equations of irreversible thermodynamics defining entropy production as a result of flow friction and heat transport are formulated. The parameters describing the flow and heat transport in these equations are determined using the Computational Fluid Dynamics (CFD) methodology. Local entropy production due to flow friction and heat transport in the channel structure is plotted and compared with flow-temperature maps and relations for flow resistance, pressure gradient, and Nusselt number derived from CFD. The calculations were performed for three gas velocities: 0.3; 2.0, and 6.0 ms−1. It was found that the entropy due to flow friction increases strongly with increasing gas velocity, while the entropy due to heat transport decreases with gas velocity, but to a limited extent. These opposing tendencies mean that there is always a minimum of the total entropy production (including these due to flow friction and heat transport), usually for moderate gas velocity. This minimum constitutes the optimum operating point of the reactor from the thermodynamic point of view.


# Metryczka

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